Non-CO_2 Greenhouse Gases: Methane

Source/Sectors: Natural Gas Systems (Production; Processing; Transmission)

Technology: Redesign blow-down systems and alter emergency shutdown practices (A.1.2.1.9; A.1.2.3.7)

Description of the Technology:
In the United States and worldwide, many efforts have been made to identify and implement mitigation options to reduce methane emissions from the natural gas sector (USEPA, 2003). For example, the Natural Gas STAR program is a voluntary partnership between US EPA and the oil and gas industry to identify and implement cost-effective technologies and measures to reduce methane emissions. The measures to reduce methane emissions from the natural gas systems can be grouped into the following mitigation strategies: prevention, recovery and re-injection, recovery and utilization, and recovery and incineration (Hendriks & de Jager, 2001).

When a system is depressurized, emissions can result from "blow-down" (i.e., venting of the high-pressure gas left within the system). This option allows methane that would be vented when compressors are taken off-line to be re-routed to the fuel gas system (USEPA, 2004a; IEA, 2003). Relocating valves closer to the compressor can reduce the volume of gas release during depressurizing at changeover or routine maintenance (Hendriks & de Jager, 2001). Modifying the emergency shutdown (ESD) vents and blow-down piping enables collection and rerouting of the gas to the sales line, the fuel box, lower pressure mains for non-emergency use, or flare systems (USEPA, 2008).

Effectiveness: Emissions savings vary by compressor stations size, operating pressure, and facility complexity. Partners of the Gas STAR program reported annual emissions reductions ranging from less than 100 Mcf per year to more than 72,000 Mcf per year (USEPA, 2008).

For one partner of the Gas STAR program, installation of a blowdown recovery system at 7 compressor stations recovered 1,155 Mcf of gas that would have otherwise been vented to the atmosphere. An additional 1,275 Mcf savings was obtained by piping connections that lowered atmospheric venting pressure to approximately 60 psi (USEPA, 2008).

Implementability: This practice applies to all compressor stations.

Reliability: Good

Maturity: Good

Environmental Benefits: Methane emission reduction; Rerouting combustible gases eliminates potential hazards in the operating area as well as reducing methane emissions (USEPA, 2008).

Cost Effectiveness:
One partner of the Gas STAR program reported methane emissions reductions of 347 Mcf per year at one compressor station. This practice can provide payback in less than three years. Gas savings from rerouting blowdown systems to a sales line or for local fuel use should justify the piping and operating costs (USEPA, 2008).

- Capital Costs (including installation) : <$1,000
- Operating and Maintenance Costs (annual) : <$100

- Payback (Years): 1-3

Technology	Lifetime (yrs)	MP (%)	RE (%)	TA (%)	Capital cost	Annual cost	Benefits
Fuel gas retrofit for blow-down valve[1]	5	100	33	21	$1.94	$0.00	$8.47

Note: MP: market penetration; RE: reduction efficiency; TA: technical applicability; costs are in year 2000 US$/$MT_{CO2\text{-}Eq.}$

1: USEPA (2004) & CEC (2005)

Industry Acceptance Level: Good

Limitations: Redesign of blow-down systems and altering ESD practices should be done in accordance with acceptable industry safety standards (OSHA, API, ANSI, ASME, and PSM).

Sources of Information:

1. California Energy Commission (2005) "Emission Reduction Opportunities for Non-CO_2 Greenhouse Gases in California", a report prepared by ICF Consulting for California Energy Commissions, CEC-500-2005-121, July 2005.
2. Hendriks, C.; de Jager, D. (2001) "Economic Evaluation of Methane Emission Reductions in the Extraction, Transport and Distribution of Fossil Fuels in the EU: Bottom-up Analysis", A final report to European Commission.
3. International Energy Agency (2003) "Building the Cost Curves for the Industrial Sources of Non-CO_2 Greenhouse Gases", Report Number PH4/25, IEA Greenhouse Gas R&D Programme, Cheltenham, United Kingdom, October 2003.
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5. U.S. Climate Change Technology Program (2005) "Technology Options for the Near and Long Term", U.S. Department of Energy, http://www.climatetechnology.gov/index.htm, August 2005.
6. U.S. Environmental Protection Agency (2003) "International Analysis of Methane and Nitrous Oxide Abatement Opportunities: Report to Energy Modeling Forum, Working Group 21", a report prepared by ICF Consulting for the United States Environmental Protection Agency.
7. U.S. Environmental Protection Agency (2004a) "International Methane and Nitrous Oxide Emissions and Mitigation Data", United States Environmental Protection Agency. Available online at www.epa.gov/methane/appendices.html (in Excel file).
8. U.S. Environmental Protection Agency (2004b) "Convert Engine Starting to Nitrogen", PRO Fact Sheet No. 101,http://www.epa.gov/gasstar/pdf/pro_pdfs_eng/convertenginestartingtonitrogen.pdf, Natural Gas Star Program, U.S. EPA, Washington DC, 2004.
9. U.S. Environmental Protection Agency (2008), Natural Gas Star Program, http://www.epa.gov/gasstar/index.htm, U.S. EPA, Washington DC, 2004.